Public Hearing, February 23rd, 2009

Good morning Senator DeFronzo, Representative Guerrera and Members of the Transportation Committee. My name is Jerry Baseel, IBM Client Executive, for IBM's Northeast Public Sector Industry. I am also a resident of Ellington, CT and have lived within our State with my family for the last 22 years.

I'm here to speak today on Senate Bill 445, An Act Concerning Congestion Pricing on Connecticut Highways. I am not here to advocate for or against this bill. As one of the world's leading implementers of "Smart Intelligent Transportation systems", I am here to let you know what is possible, what other governments around the world have implemented and what we have found based on the systems we have implemented and the data that has been collected.

I've also included in your handout a recent article in the Wall Street Journal that re-inforces the technology movement that will inevitably take place within our society.

I want to reiterate that as Client Executive, I am not a transportation industry consultant. Our IBM consultants in this role were unable on short notice to be here today. I would be happy to have our consultants come address in further detail how these intelligent transportation systems work and what the future holds for these.

There are many questions that must be answered before these systems can be implemented. Lawmakers must determine whether these systems are being used to raise revenue, relieve congestion, and collect data or any combination of such.

In London, Singapore, Edinburgh and Stockholm, these systems have shown positive results. Here in the US, although we are somewhat behind other countries, many governments and metropolitan areas are beginning to become active, similar to Connecticut at looking how Intelligent Transportation systems can help provide answers to those issues raised above.

CONGESTION

Pilot
Referendum
Improved Infrastructure

In Stockholm, a dynamic toll system based on the flow of vehicles into and out of the city has reduced traffic by 20%, decreased wait time by 25% and cut emissions by 12%. In Singapore, controllers receive real-time data through sensors to model and predict traffic scenarios with 90% accuracy. And in Kyoto, city planners simulate large-scale traffic situations involving millions of vehicles to analyze urban impact.

In the U.S. alone, 3.7 billion hours are lost every year to people sitting in traffic, and 2.3 billion gallons of fuel – enough to fill 58 supertankers – burn needlessly, at a cost to the economy of $78 billion per year.

REVENUES

Connecticut Gas Tax- Technologies will force lawmakers to seek alternative ways of funding

Higher Gas Mileage Vehicles
Electric Vehicles
Hybrids/Solar, etc.

Using and wearing down your infrastructure without contribution

THE WALL STREET JOURNAL.

Technology (A Special Report) --- Smart Roads; Smart Bridges; Smart Grids: If we are going to spend billions of dollars to fix our ailing infrastructure, let's make sure we do it right; Here are the technologies to make that happen

By Michael Totty
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It's time the U.S. got a lot smarter.

Federal, state and local governments are about to pour tens of billions of dollars into the nation's infrastructure. The big question: Will we simply spend the money the way we've been doing for decades -- on more concrete and steel? Or will we use it to make our roads, bridges and other assets much more intelligent?

Imagine highways that alert motorists of a traffic jam before it forms. Or bridges that report when they're at risk of collapse. Or an electric grid that fixes itself when blackouts hit.

This vision -- known as "smart" infrastructure -- promises to make the nation more productive and competitive, while helping the environment and saving lives. Not to mention saving money by making what we've got work better and break down less often.

But fail to upgrade, advocates warn, and the country may be locked into the old way of building for decades to come.

"The goal is not just funding projects for short-term job gains," says Paul Feenstra, vice president of government affairs at the Intelligent Transportation Society of America, a group that promotes smart-road technologies. "It should be to create systems that are intelligent and improve productivity in the long run."

Powering the smart infrastructure are the latest advances in sensors, wireless communications and computing power, all tied together by the Internet. Not surprising, then, that the giants of the technology world -- International Business Machines Corp., General Electric Co., and others -- are leading the push for smarter infrastructure, joined by a host of civic planners and researchers.

Still, despite the big names behind the projects, immediate results are unlikely. Some smart-technology projects are "shovel ready" and could be deployed fairly quickly, but a lot of the technologies are still in the test or development phase and might not be available for five years or more.

With that in mind, here's a look at the kinds of technology leaps that could take our decades-old infrastructure to new levels of intelligence.

SMART TRANSPORTATION

Traffic congestion cuts into worker productivity, delays deliveries, eats up gasoline and boosts air pollution. And it's annoying.

For decades, experts have argued that the best way to fight congestion is intelligent transportation systems, such as roadside sensors to measure traffic and synchronized traffic lights to control the flow of vehicles. But the spread of these technologies has been limited by cost. Now stimulus money could change all that.

One promising avenue: real-time information about road conditions, traffic jams and other events. People can increasingly find that data on the Web with services such as Google Maps. But the next generation of technologies promises to get that news -- and even more detailed information -- directly to drivers in their cars. Armed with that information, drivers can make better decisions about which routes to take -- which can have a big effect on traffic.

The first step is collecting better data about traffic flows. The California Department of Transportation, or Caltrans, has installed radio receivers along several freeways in the San Francisco Bay area that read the electronic toll tags in passing cars. Using that information, Caltrans can track the speed of individual vehicles and determine the travel time from one point to another. Then those times are posted on electronic road signs. (Caltrans officials say they don't keep track of personally identifiable information from the tags, to protect privacy.)

Eventually, the data from the roadside sensors could help traffic controllers guide drivers to other travel alternatives: Is a bus or a train faster than the freeway? To that end, Caltrans and the Bay area's Metropolitan Transportation Commission are testing three electronic signs south of San Francisco. Along with freeway travel times, the signs show scheduled travel and arrival times on Caltrain. Drivers can see if they'd be better off getting out of heavy traffic, heading to a station and catching a train.

In the future, planners intend to show real-time train travel and arrival times, as well as the number of available parking places at the nearest station.

Another way to ease congestion is to predict traffic jams before they form. IBM has developed software that can examine current traffic patterns and foresee congestion up to 45 minutes ahead. The system, being tested in Singapore, has proved to be about 90% accurate in predicting the volume and speed of drivers in the central business district. The information is then used to adjust 1,700 sets of traffic lights to smooth the flow of traffic.

"We say that real time is too late," says Naveen Lamba, leader of IBM's global intelligent-transportation efforts. "You have to see into the future to minimize the impact of what's going to happen."

Some researchers are attacking another source of traffic backups: accidents. Trimming the time it takes to clear the roadway after a crash would help ease congestion. Reducing the number of accidents would be even better -- lowering injuries and fatalities, as well as costs associated with accidents.

Enter a concept called vehicle infrastructure integration, or VII. These systems would let roads, traffic signals and vehicles talk to each other, and share crucial information automatically, by using a range of technologies -- GPS navigation, wireless communications, advanced sensors and onboard computers. For instance, a car in an accident could send out an automatic message about the time, location and severity of the crash to receivers along the roadside, which would then automatically dispatch emergency vehicles.

Lane and traffic signals are being tested that can warn drivers of dangerous situations, such as approaching a curve or stoplight too fast. The signs would communicate wirelessly with the vehicle and deliver warnings through an in-dash display, like those used in GPS navigation systems, or use radio signals to send warnings to a vehicle's sound system.

Caltrans is testing a left-turn signal that flashes a big red arrow with a slash through it when it detects a vehicle is approaching rapidly from the opposite direction. For now, the arrow flashes on the signal itself; the goal is to have the warning beamed directly into the turning vehicles.

Even the ultimate science-fiction vision -- roadways that control vehicles and make "driving" unnecessary -- isn't that far in the future. Mr. Lamba says IBM is in discussions with a small city to build a completely automated transportation system that would include 3,000 remote-controlled vehicles. The company won't identify the city or give any other details.

A SMART GRID

The U.S. electricity grid is arguably one of the most important technological achievements of the 20th century. And yet, it's pretty dumb. Power flows one way, but the utility gets back very little information about how it's being used. And the grid is poorly set up to handle power coming in from alternative-energy sources, such as wind farms.

New technologies could add much more intelligence to the system.

The first step is installing advanced electric meters that send a steady stream of information back to the utility. They make it possible to read meters remotely and to determine more precisely the location of power outages. And they can give customers a more detailed view of their electricity use.

Beginning next month, Houston-based CenterPoint Energy Inc. is preparing to install more than two million smart meters over five years. During a two-year test of the technology, consumers were able to call up a Web portal showing the energy consumption of the home's major appliances. Consumers also could calculate energy bills in different situations: What would be the effect of keeping the house at 75 degrees in the summer instead of 65? What adjustments would be necessary to keep summer electric bills under $200?

Next, a new generation of smarter appliances could help consumers curtail energy use and help utilities reduce pressure on the grid.

In a test by the Department of Energy's Pacific Northwest National Laboratory, 75 homes in Washington and Oregon were given water heaters or clothes dryers that could respond to tiny fluctuations in electricity. The appliances would reduce their power consumption automatically if they detected a drop in current frequency -- an early warning of potential power outages. For instance, the clothes dryer -- a special model built for the project by Whirlpool Corp. -- would continue spinning but without heat. Most homeowners in the test said they didn't notice the brief power drops.

"If we could get every appliance in America doing this, we could have a major safety net for the grid," says Rob Pratt, a staff scientist who manages smart-grid research at the lab.

A smarter grid could also help manage the increased use of wind and solar power. Since these alternative-energy sources can rise or fall abruptly, utility operators are forced to ramp up other power sources or reduce demand quickly to make up for the loss.

The University of Hawaii, in partnership with local utilities and GE, recently launched a research project to test how various smart-grid technologies handle the use of wind power. The island of Maui has one large wind farm; when the wind drops suddenly, as much as 15% of the island's total amount of power consumed can drop off the grid and has to be replaced by power from fossil-fuel plants.

GE will deploy rechargeable batteries that can store power when winds are high and can automatically send power back to the grid when the wind drops. Researchers will also test smart meters and appliances that can be controlled remotely by the utility to reduce demand if necessary.

A smart grid would even be able to partly heal itself. Today, when a storm drops a tree branch on a power line, utilities typically have to rely on customer calls to locate the damage and assess the scope of the outage. CenterPoint is testing special sensors and switches that sit alongside power lines and detect sudden changes in the amount of current through the wire. The utility then can quickly route power around the break, restoring electricity within seconds to a large part of the blacked-out area and limiting the number of households affected.

SMART BRIDGES

Looking for structural problems with the nation's 600,000 bridges mostly still requires a visual inspection, which can be inconsistent and expensive. A better alternative, engineers say, would be continuous electronic monitoring of bridge structures using a network of sensors at critical points. These devices can deliver data about how a bridge behaves under heavy traffic, in high winds or other conditions. And they can spot potentially serious problems long before they might be apparent to a human inspector.

"No matter what we do, there are limits to human sensing capabilities," says Mohammed Ettouney, a principal in Weidlinger Associates Inc., a New York engineering firm. "We can't see hidden cracks, we can't feel the erosion after a flood." Automatic detection, he says, "can make the difference between a major disaster, a costly retrofit or a minor retrofit."

Consider the bridge in Minneapolis that replaced the I-35 structure that collapsed in 2007. The new bridge holds more than 300 sensors that measure the effects of corrosion, temperature changes and winter de-icing. In addition to helping transportation officials monitor the health of the bridge, researchers at the University of Minnesota are analyzing the data to help design bridges better able to handle all the stresses.

"We have a long way to go before we get to the point where we have true smart-bridge technology -- where the bridge can tell you there are problems" rather than simply collect data for analysis, says Catherine French, a civil-engineering professor at the University of Minnesota.

To get closer to that goal, the National Institute of Standards and Technology last month awarded grants to programs researching and developing smart-bridge technologies, including sensors that can report back instantly if a problem appears.

The University of Texas at Austin received a grant to create wireless networks of sensors to monitor cracks in existing bridges where the failure of a single piece could bring down the entire structure. Because getting power to the sensors can be a problem, the group is studying how to use the vibrations of the bridge to generate electricity for the devices. It's also working on devices with enough computing power to analyze the stream of data and send alerts when potentially serious damage occurs.

Looking beyond traditional sensor technologies, another grant went to a group led by the University of Michigan. The group is developing smart materials that can be built into or applied to key bridge components to detect and measure changes. For instance, researchers are working on a sensing "skin" that can carry electrical or magnetic signals to give a two-dimensional picture of how the structure responds to different stresses, says Jerome Lynch, an assistant professor at the university.

SMART WATER SYSTEMS

The world's fresh-water supplies -- and the pipes, levees and other systems for handling it -- are under pressure from growing populations, expanding demands from agriculture and environmental changes wrought by global warming. But knowledge about those systems isn't as thorough or timely as it could be.

Take leak detection. In the U.S., about 15% of municipal water is lost to leaks, accounting errors or other unbilled consumption. While technology for detecting and then pinpointing leaks has become more sophisticated, it's still largely a manual, time-consuming process. Checking an entire water system can take weeks.

What's on the horizon? Sensors from U.K. start-up Syrinix Ltd. can continuously monitor for leaks on major trunk lines used to carry water from reservoirs and water-treatment plants. The company's sensors measure subtle changes in sound waves through the water and the pipe itself. When they detect the sound of a small leak -- which can lead to bigger line failures -- the information is carried over high-speed phone lines, and the system automatically sends out an email or text-message alert. The system is currently deployed on about 16 miles of lines in London and Birmingham. There haven't yet been any leaks in the portions being monitored.

Another big area of research is protecting levees, particularly in the wake of Hurricane Katrina. As part of an initiative by the Dutch government to prepare for rising ocean levels and an increase in severe storms, a handful of government agencies and businesses created a test site with a smart levee -- one loaded with dozens of sensors that measure water levels, pressure changes, ground movements and the condition of the dike. When researchers intentionally caused the levee to fail, it produced a wealth of data that eventually could be used to predict a failure well before it occurs.

"If you can build smart infrastructure on top of the physical infrastructure, you could have some level of advanced knowledge about the levees [and] a better indication of whether you need to evacuate people or whatever," says Sharon Nunes, vice president of Big Green Innovations at IBM, which participated in the Netherlands test.

The company is part of another water-management project with the Beacon Institute, an environmental research organization in upstate New York. Researchers there are working on a network of sensors to collect and monitor data about the Hudson River. The project tested its first floating platform of sensors late last summer and plans eventually to have devices scattered along the entire 300-mile length of the river.

One of the big challenges for the project is making sense of the huge stream of data produced by the sensor network. So IBM is providing software that can process all this information and quickly generate conclusions, allowing officials to respond immediately to developments on the river, rather than wait for hours or days to analyze data.

For instance, says John Cronin, the Beacon Institute's chief executive, power plants along the Hudson take in huge amounts of water for cooling, but in the process they can kill millions of young striped-bass larvae. So, the plants are under pressure to install expensive new cooling systems that don't pull in as much river water.

With a sensor network, officials could spot the tide of tiny bass larvae and notify the utility to shift power production to another plant until the creatures pass. The system would thus protect the fish -- and make the purchase of new equipment unnecessary.

"This is a version of smart ecosystem management that we don't have the technological capability for now," Mr. Cronin says. With the sensor network, "we're on the doorstep of a whole new world of understanding and protecting ecosystems."

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